PROCESS AN]) MI:T1 101X)1 .OGY OF DEVELOPING CASSINIG&C TELEMETRY l)1C"I'I0NAR%

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ABSTRACT

An efficient ground data system anti effective telemetry data processing: / analysis system stem from good engineering design with respect to timeliness, frequency, accuracy, anti sufficiency of' the data contents in the telemetry stream. The human interaction with the data, thence consumption of' the data, can also be enhanced by human-engineered telemetry displays and systematic organization of the telemetry measurements.

Such objectives can be achieved, in part, by an up front design of a flexible and efficient telemetry handling system on board the spacecraft, and of an equally efficient ground data analysis system. A common thread between the flight and ground systems is the Telemetry Dictionary.

in the present context, the Telemetry Dictionary is more than just a collection of telemetry measurements with their descriptions, arranged in some alphabetical ordering. The attributes associated with each telemetry entry extend to the assignment of' "mini-packet" type, periodicity of the mini-packet type, software and hardware association, flight software variable type/size declaration, telemetry "DN" type/size declaration, scale factor conversion, "DN" bit assignment etc. in Cassini, the method of "packet telemetry" using variable periodicity mini-packets is engineered.

This paper describes the systematic process anti methodology in the development of the Cassini Attitude and Articulation Control Subsystem (AACS) Telemetry Dictionary.

Whereas the AACS flight software had an object-oriented design, the fundamental collection of telemetry was per software object. A bottoms-up approach was used to assemble and analyze the telemetry measurements per software object. A database was constructed in which each measurement (i.e. record) was associated with attributes including E-number, mini-packet, software object, channel type, bit assignment, scale factor etc.

Through iterative analysis, the collection of' measurements was screened, organized, anti assigned to the fundamental unit of a telemetry mini-packet. Mini-packets were created that grouped measureme1 Its by similar functions and/or similar

collection periods. A systematic optimization of mini-packet assignments led to the consolidation of the database, from which statistics were synthesized and analyzed. AACS telemetry modes were designed corresponding to the overall spacecraft telemetry modes - a virtue of the flexibility of a]nini-packet packetized telemetry system. Telemetry maps specifying the periodicity of telemetry mini-packets were designed, satisfying overall spacecraft telemetry bandwidth allocation requirements.

Additionally, the measurements were ordered with a numbering scheme, and their mnemonics were designed to human engineering standards. This database was also compared to the misting Galileo AACS Telemetry Dictionary, as a means of exploring possible omission and for confirming completeness.

The end result provided the design for the "Telemetry Manager" flight soft ware obj ect, a "contract" specification of telemetry measurements for all other software objects, a feedback to software control algorithm design as a by-product of telemetry bandwidth optimization, a specification for the ground data system channelization process and display process, and above all, the Telemetry Dictionary.

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